ZooKeys 1108: 141–159 (2022)
doi: 10.3897/zookeys.1108.83267
https://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Taxonomic and nomenclatural notes on Chinese species of *Sarcophaga* Meigen, 1824 (Diptera, Sarcophagidae)

Chao Wang[1,2], Haoran Sun[2], Weibing Zhu[3], Thomas Pape[4], Qiyong Liu[1], Dong Zhang[2]

1 *State Key Laboratory of Infectious Disease Prevention and Control, WHO Collaborating Centre for Vector Surveillance and Management, National Institute for Communicable Disease Control and Prevention, Chinese Center for Disease Control and Prevention, Beijing 102206, China* **2** *School of Ecology and Nature Conservation, Beijing Forestry University, Beijing 100083, China* **3** *Center for Excellence in Molecular Plant Science, Chinese Academy of Sciences, Shanghai 200032, China* **4** *Natural History Museum of Denmark, University of Copenhagen, Universitetsparken 15, DK-2100, Copenhagen, Denmark*

Corresponding authors: Qiyong Liu (liuqiyong@icdc.cn), Dong Zhang (ernest8445@163.com)

Academic editor: Liping Yan | Received 8 March 2022 | Accepted 21 May 2022 | Published 24 June 2022

https://zoobank.org/939DAE08-5A69-41C5-8EA9-D0DDBF4BEF03

Citation: Wang C, Sun H, Zhu W, Pape T, Liu Q, Zhang D (2022) Taxonomic and nomenclatural notes on Chinese species of *Sarcophaga* Meigen, 1824 (Diptera, Sarcophagidae). ZooKeys 1108: 141–159. https://doi.org/10.3897/zookeys.1108.83267

Abstract

New taxonomic and nomenclatural data are provided for Chinese species of *Sarcophaga* Meigen, 1824. Eight new synonyms are proposed: two at the genus level, *Magnicauda* Wei, 2005 **syn. nov.** = *Sarcophaga* Meigen, 1824 and *Leigongshanophaga* Lehrer & Wei, 2010 **syn. nov.** = *Sarcophaga* Meigen, 1824, two at the subgenus level, *Magnicauda* Wei, 2005 **syn. nov.** = *Pterosarcophaga* Ye, 1981 and *Leigongshanophaga* Lehrer & Wei, 2010 **syn. nov.** = *Cornexcisia* Fan & Kano, 2000, and four at the species level, *Sarcophaga catoptosa* Wei & Yang, 2007 **syn. nov.** = *Sarcophaga suthep* Pape & Bänziger, 2003, *Pierretia daozhenensis* Wei, 2005 **syn. nov.** = *Sarcophaga sichotealini* (Rohdendorf, 1938), *Pierretia autochthona* Wei & Yang, 2007 **syn. nov.** = *Sarcophaga* (*Liosarcophaga*) *kanoi* Park, 1962, and *Parasarcophaga simultaneousa* Wei & Yang, 2007 **syn. nov.** = *Sarcophaga huangshanensis* (Fan, 1964). *Sarcophaga* (*Liosarcophaga*) *aegyptica* Salem, 1935 is considered a senior synonym of *Sarcophaga* (*Liosarcophaga*) *parkeri* (Rohdendorf, 1937). Correct original spellings are established, by First Reviser action, for the genus-group names *Magnicauda* Wei, 2005 and *Pterosarcophaga* Ye, 1981 and for the species-group name *Magnicauda linjiangensis* Wei, 2005. Chinese material of *Sarcophaga* (*Bellieriomima*) *genuforceps*, *S.* (*Robineauella*) *huangshanensis* (holotype and paratype), *S.* (*Liosarcophaga*) *kanoi*, and *S.* (*L.*) *aegyptica* is photographed for the first time.

Copyright *Chao Wang et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Keywords
Leigongshanophaga, *Magnicauda*, new synonyms, nomenclature, original spellings, revision, *Sarcophaga*, taxonomy

Introduction

Sarcophaga Meigen, 1824 (*sensu lato*) is by far the largest genus in the Sarcophagidae, and with upwards of a thousand species it is also one of the largest genera of Diptera (Whitmore et al. 2013; Wang et al. 2019, 2020; Evenhuis and Pape 2021). The genus is widespread, and the adults are very homogeneous in their external morphology and often recognizable at the species level only through a detailed study of the male terminalia (Buenaventura et al. 2017), for which professional skills as well as considerable experience are needed. The uniformity in external appearance stands in strong contrast to the marked structural complexity of the male terminalia, where phallic morphology in particular has diversified through the evolution of variously shaped appendages, the homologies of which are often obscure. The diversity and variability of the male terminalia, combined with the practical need to break up the large *Sarcophaga* (*sensu lato*) into smaller taxa, has brought about a high number of genus-level and species-level synonyms (Pape 1996; Wang et al. 2019, 2020). Ongoing studies of the Chinese fauna of *Sarcophaga* has led to the recognition of several new synonyms, which are presented here together with relevant taxonomic and nomenclatural details.

Material and methods

Specimens examined or otherwise mentioned are deposited at the following institutions:

CDCP	Center for Disease Control and Prevention of Anshun city, Guizhou province, China;
MNHN	Muséum national d'Histoire naturelle, Paris, France;
MBFU	Museum of Beijing Forestry University, Beijing, China;
NHMD	Natural History Museum of Denmark;
SECA	Shanghai Entomological Museum, Chinese Academy of Sciences, Shanghai, China;
SMNH	Swedish Museum of Natural History.

Identifications were aided by the keys in the publication of Fan (1992), combined with extensive comparisons against specimens in the reference collections of MBFU and NHMD, supplemented by a library of images of male terminalia and the original descriptions. We follow Roback (1954), Downes (1965), Pape (1996), Pape and Dahlem (2010), Giroux et al. (2010), Richet et al. (2011), Whitmore et al. (2013), Buenaventura et al. (2017), and Buenaventura and Pape (2018) in a broad definition of the genus *Sarcophaga*. External morphology was examined with an Olympus SZX16 stereomicroscope, and pho-

tographs were taken with a Canon 600D camera mounted on the same microscope. Images were processed in Adobe Photoshop CS 6 (Adobe Systems, Inc., San Jose, CA, USA) and stacked in Helicon Focus 3.2 (Helicon Soft Ltd, Kharkov, Ukraine). Inked illustrations were done by tracing over a photograph or figures from the original descriptions. The International Code of Zoological Nomenclature (ICZN 1999) is referred to as "the Code".

Taxonomy and nomenclature

Genus *Sarcophaga* Meigen, 1824

Sarcophaga Meigen, 1824: 305. Type species: *Musca carnaria* Linnaeus, 1758, by subsequent designation of Partington (1837: 607).

Magnicauda Wei, 2005: 405. Type species: *Magnicauda linjiangensis* Wei, 2005, by original designation. Syn. nov.

Maginicauda: Wei (2005: 409). Incorrect original spelling of *Magnicauda*, by First Reviser action in the present paper.

Leigongshanophaga Lehrer & Wei, 2010: 8. Type species: *Sarcophaga catoptosa* Wei & Yang, 2007 [= *Sarcophaga suthep* Pape & Bänziger, 2003], by original designation. Syn. nov. For other synonyms, see Pape (1996).

Remarks. Verves and Khrokalo (2020: 204) proposed *Leigongshanophaga* Lehrer & Wei, 2010 as a new synonym of the valid genus *Rosellea* Rohdendorf, 1937, but Xue et al. (2011: 320) proposed the same earlier. As argued below, we consider *Sarcophaga catoptosa* Wei & Yang, 2007, which is the type species of *Leigongshanophaga* Lehrer & Wei, 2010, to be a synonym of *Sarcophaga suthep* Pape & Bänziger, 2003, syn. nov., and we follow Wang et al. (2019) in treating this species in *Sarcophaga* subgenus *Cornexcisia* Fan & Kano, 2000.

Subgenus *Bellieriomima* Rohdendorf, 1937

Bellieriomima Rohdendorf, 1937: 164 (as subgenus of *Thyrsocnema* Enderlein, 1928). Type species: *Sarcophaga laciniata* Pandellé, 1896 [= *Sarcophaga subulata* Pandellé, 1896], by original designation.

Sarcophaga (*Bellieriomima*) *genuforceps* Thomas, 1949

Figs 1, 2

Sarcophaga genuforceps Thomas, 1949: 172. China, Sichuan, Chungking, Chinyunshan.
Pierretia catharosa Wei & Yang, 2007: 530. China, Guizhou, Leigongshan.

Material examined. 1♂, China, Zhejiang, Tianmu Mountain, 600–1100 m, 30.vi.1964, Huitai Fang leg. (SECA).

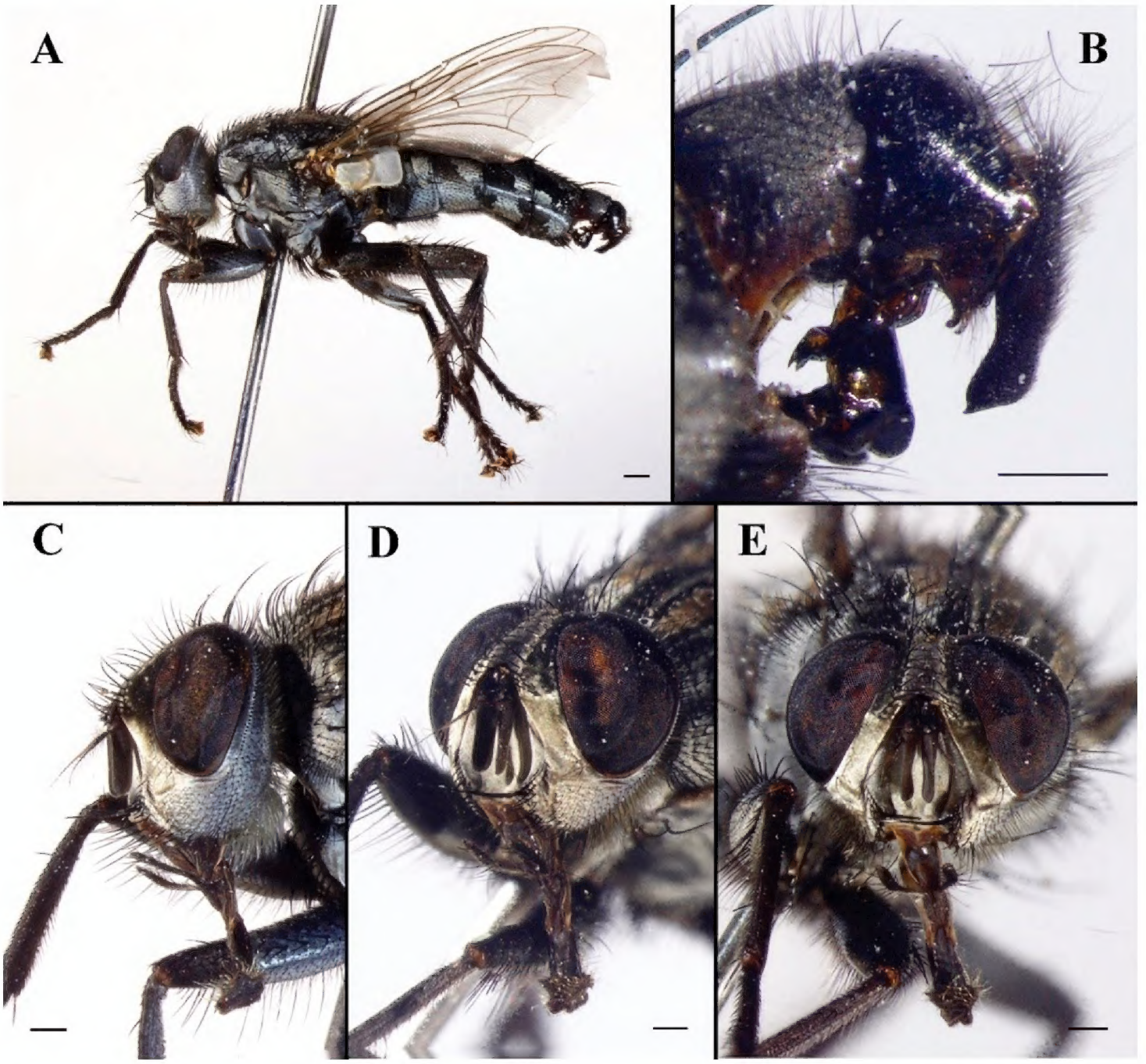

Figure 1. *Sarcophaga* (*Bellieriomima*) *genuforceps* Thomas, 1949; male (China, Zhejiang, Tianmu Mountain; in SECA) **A** habitus, lateral view **B** terminalia, lateral view **C** head, lateral view **D** head, anterolateral view **E** head, anterior view. Scale bars: 1 mm.

Remarks. The holotype of *Pierretia catharosa* is deposited in CDCP and not currently available for loan and study. Verves (2020: 36) listed *P. catharosa* as a junior synonym of *S. genuforceps*, although not as a new synonym. Wei and Yang (2007) gave a detailed description and a somewhat schematical illustration of the phallus (Fig. 2B), which is here considered sufficient justification for the synonymy. Xue and Verves (2009: 53) considered *S. genuforceps* to belong to *Pachystyleta* Fan & Chen, 1992, as a subgenus of *Myorhina* Robineau-Desvoidy, 1830, whereas Lehrer (2010: 18) raised *Pachystyleta* to genus rank. We prefer to follow the classification of Pape (1996), with *Pachystyleta* as a synonym of *Bellieriomima* and the latter as a subgenus of *Sarcophaga* (*sensu lato*).

Figure 2. *Sarcophaga* (*Bellieriomima*) *genuforceps* Thomas, 1949; phallus, lateral view **A** adapted from Lehrer (2012) **B** adapted from Wei and Yang (2007, as *Pierretia catharosa*).

Subgenus *Cornexcisia* Fan & Kano, 2000

Cornexcisia Fan & Kano, 2000: 251. Type species: *Cornexcisia longicornuta* Fan & Kano, 2000, by original designation.
Leigongshanophaga Lehrer & Wei, 2010: 8. Type species: *Sarcophaga catoptosa* Wei & Yang, 2007 [= *Sarcophaga suthep* Pape & Bänziger, 2003], by original designation. Syn. nov.

***Sarcophaga* (*Cornexcisia*) *suthep* Pape & Bänziger, 2003**
Fig. 3

Sarcophaga suthep Pape & Bänziger, 2003: 52. Thailand, Chiang Mai Province, Doi Suthep.
Sarcophaga catoptosa Wei & Yang, 2007: 531. China, Guizhou, Leigongshan. Syn. nov.
Sarcophaga sutbeb: Wei and Yang 2007: 532. Incorrect subsequent spelling of *S. suthep* Pape & Bänziger, 2003.

Material examined. ***Holotype*** of *S. suthep*: ♂, Thailand, Chiang Mai Province, Doi Suthep, above Sangwal School, 1240 m, 28.viii.2000, H. Bänziger (in SMNH;

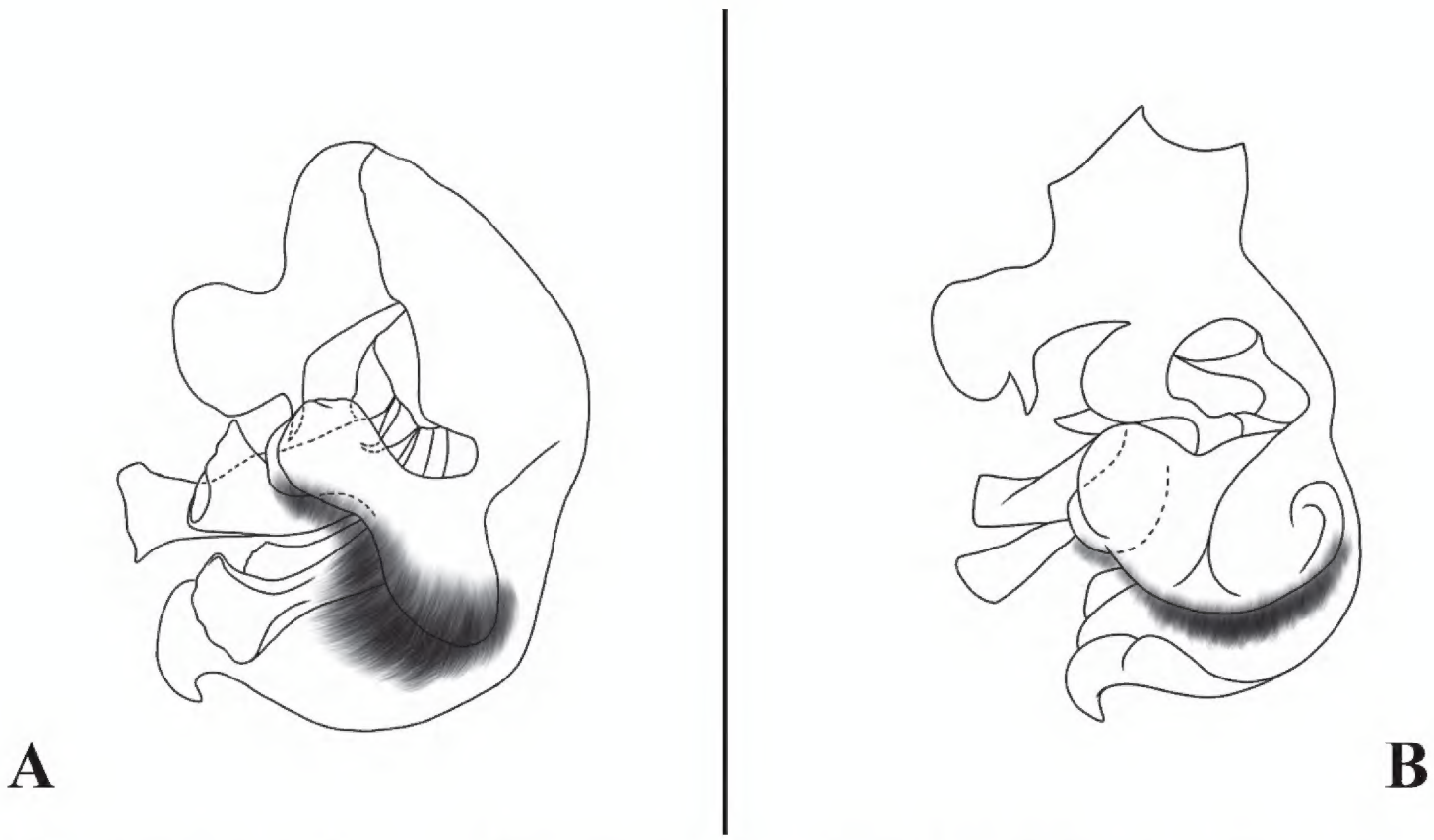

Figure 3. *Sarcophaga* (*Cornexcisia*) *suthep* Pape & Bänziger, 2003; phallus, lateral view **A** adapted from Pape and Bänziger (2003) **B** adapted from Wei and Yang (2007, as *Sarcophaga catoptosa*).

specimen dissected and with terminalia glued to a piece of cardboard pinned below the specimen).

Remarks. The holotype of *Sarcophaga catoptosa* is deposited in CDCP and not currently available for loan and study. Wei and Yang (2007) described the lateral styli as bifurcated at the base and expanded at the apex (Fig. 3). This unique character in *Sarcophaga* is shared by *S. suthep* and other species assigned to the subgenus *Cornexcisia*. We consider the following compelling similarities between the nominal species *S. suthep* and *S. catoptosa*, as assessed from the illustrations of the phallus (Fig. 3), to justify the proposed synonymy: vesica of identical shape; juxta, harpes and lateral styli differing only by small differences in the outline, and this involves membranous parts that are often presenting themselves very differently due to shrinking during drying or other preparation. Wei and Yang (2007) stressed the following difference between *catoptosa* and *suthep*: the protuberance of former cerci is slightly narrower than the latter in dorsal view and the hind margin of former pregonite is wavy bending with a sharper tip, but those differences are minor. They still have the same shape, only varying in degree. Therefore, we consider these to be intraspecific differences.

Subgenus *Liosarcophaga* Enderlein, 1928

Liosarcophaga Enderlein, 1928:18. Type species: *Cynomya madeirensis* Schiner, 1868, by original designation.

***Sarcophaga* (*Liosarcophaga*) *aegyptica* Salem, 1935**
Fig. 4

Sarcophaga dux aegyptica Salem, 1935: 56. Egypt, Alexandria; Egypt, Abbassieh; Egypt, Monsouriah.
Parasarcophaga (*Liosarcophaga*) *parkeri* Rohdendorf, 1937: 217. Ukraine, south shore of Crimea.

Material examined. 1♂, China, Qinghai, Minhe, 22.vii.1976, Shaoyuan Ma leg. (SECA).

Remarks. There has been disagreement among authors as to whether *Parasarcophaga parkeri* is a valid species or a junior synonym of *S. aegyptica*. Rohdendorf (1937) evidently knew Salem's (1935) work on *Sarcophaga* (s.l.) from Egypt, but he did not study any material identified as *S. aegyptica* and therefore quoted Salem's description. Furthermore, the diagnostic differences in the shape of the juxtal arms and

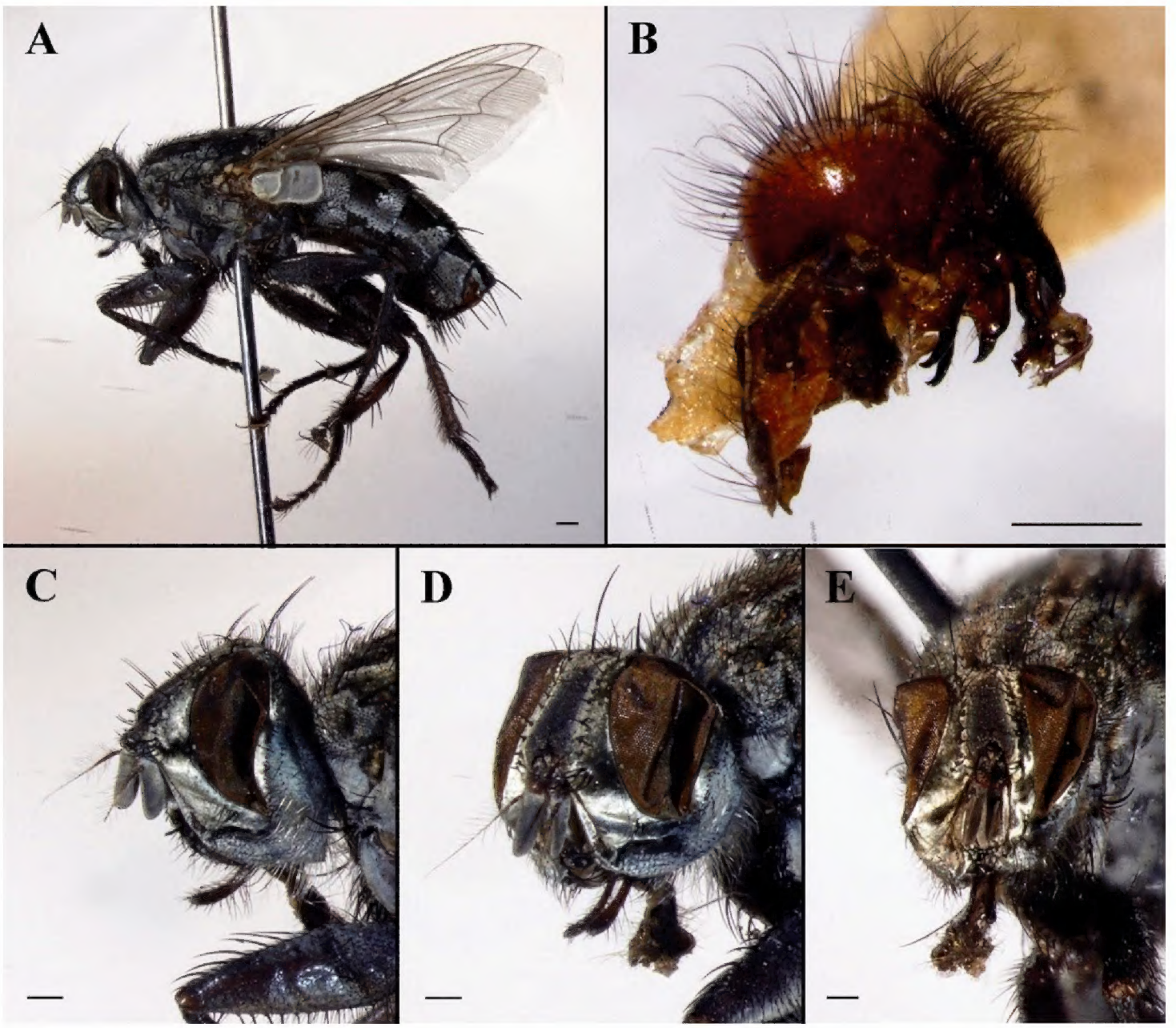

Figure 4. *Sarcophaga* (*Liosarcophaga*) *aegyptica* Salem, 1935; male (China, Qinghai; in SECA) **A** habitus, lateral view **B** terminalia, lateral view **C** head, lateral view **D** head, anterolateral view **E** head, anterior view. Scale bars: 1 mm.

harpes outlined in the key by Rohdendorf (1937: 440) were assessed based on Salem's illustrations. Gregor and Povolný (1960) synonymized the two nominal species, which was accepted by Rohdendorf (1970), and these taxa have since been considered either as separate species, e.g., by Lehrer (1995), Pape (1996), El-Ahmady et al. (2018), and Verves and Khrokalo (2020), or as synonyms, e.g., by Xue and Chao (1998), Nandi (2002), Povolný and Hula (2004), and Richet et al. (2011). The recent conspectus of Egyptian species of *Sarcophaga* (s.l.) by El-Ahmady et al. (2018) separated *aegyptica* and *parkeri* by vesica with two short processes apically and narrow harpes (*aegyptica*) versus vesica with three short processes apically and broad harpes (*parkeri*). The material at our disposal was not sufficient for a thorough assessment of the relevant morphological characters, but we have the impression that both the vesica and the harpes are variable structures, which furthermore present themselves very differently depending on the type of preparation and condition of the specimen. We have therefore chosen a conservative approach and consider the two nominal taxa as synonyms.

Sarcophaga (*Liosarcophaga*) *kanoi* Park, 1962

Fig. 5

Sarcophaga (*Liosarcophaga*) *kanoi* Park, 1962: 6. South Korea, Taegu, Mt Pal-gong.
Pierretia autochthona Wei & Yang, 2007: 529. China, Guizhou, Leigongshan. Syn. nov.
Pierretia autochtona: Verves 2020: 37, incorrect subsequent spelling of *P. autochthona*.

Material examined. 1♂, China, Shanghai (Zi-Ka-Wei), 3.ix.1917, no further data (MNHN). 1♂, China, Hunan, Anxiang, Guandang, 20–21.vii.2012, Ming Zhang leg.; 1♂, China, Hunan, Anxiang, Guandang, 7.vii.2013, Ming Zhang leg.; 3♂♂, China, Hubei, Shishou, Gaoling, 8.vii.2013, Ming Zhang leg.; 1♂, China, Beijing, Beijing Forestry University, 9.vii.2016, Miao Jiang & Yunyun Gao leg. (MBFU).

Remarks. Wei and Yang (2007) considered *P. autochthona* as close to *S.* (*Pseudothyrsocnema*) *caudagalli* Böttcher, 1912, but we are here proposing a synonymy with *S.* (*L.*) *kanoi*. Wei and Yang (2007: fig. 72) illustrated the phallus of the holotype of *P. autochthona* as having a short, arm-like extension arising from the left lateral part of the distiphallus (probably the proximal part of the juxta) and a long, slender, process arising from the right lateral part of the distiphallus (Fig. 6). We consider this apparent asymmetry to be an artefact, and possibly an inaccuracy of the original illustration. This could not be confirmed because the holotype of *P. autochthona*, deposited in CDCP, has not been available for study through ordinary loan.

Subgenus *Phallantha* Rohdendorf, 1938

Phallantha Rohdendorf, 1938: 101. Type species: *Phallantha sichotealini* Rohdendorf, 1938, by original designation.

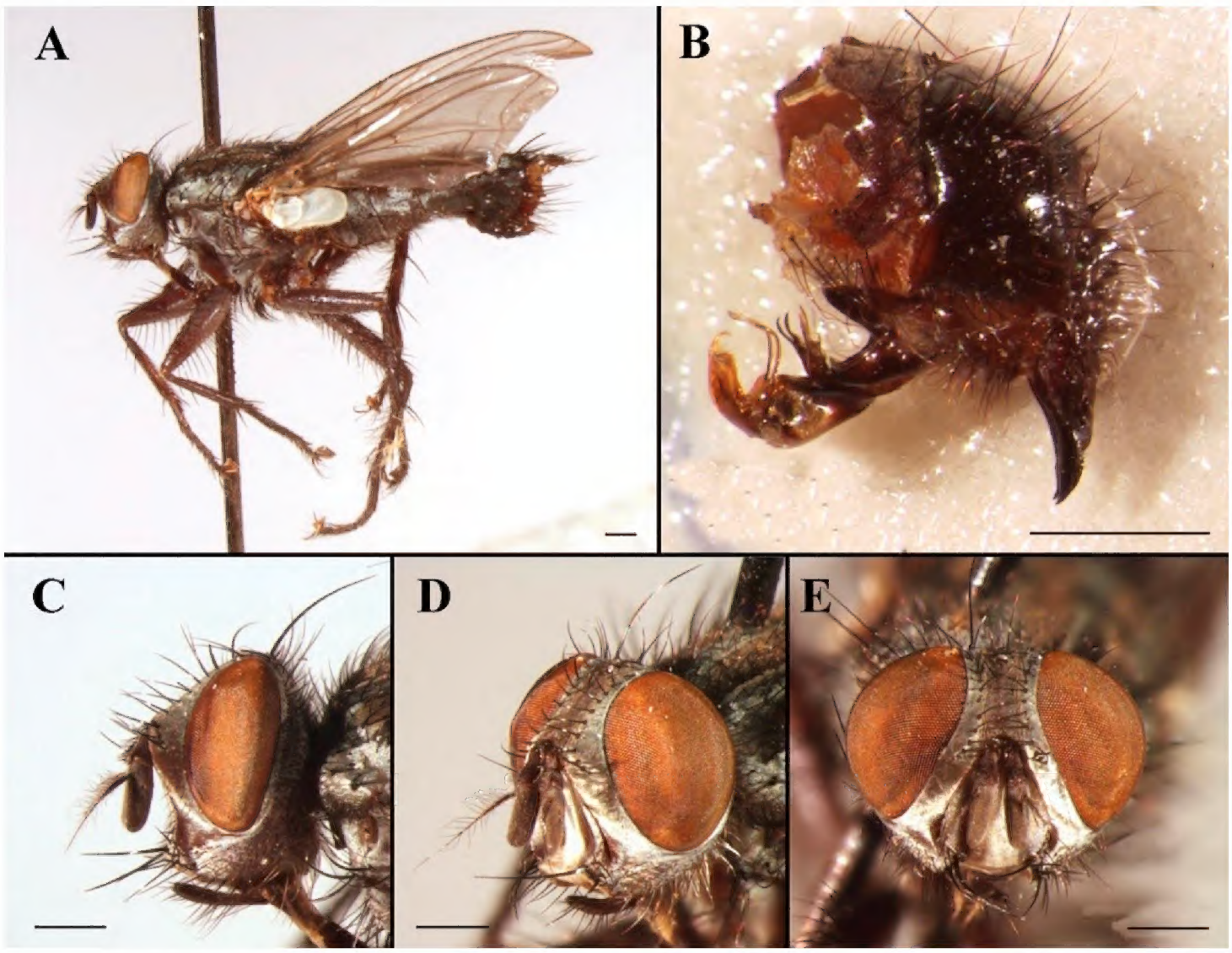

Figure 5. *Sarcophaga* (*Liosarcophaga*) *kanoi* Park, 1962; male (China, Hubei; in MBFU) **A** habitus, lateral view **B** terminalia, lateral view **C** head, lateral view **D** head, anterolateral view **E** head, anterior view. Scale bars: 1 mm.

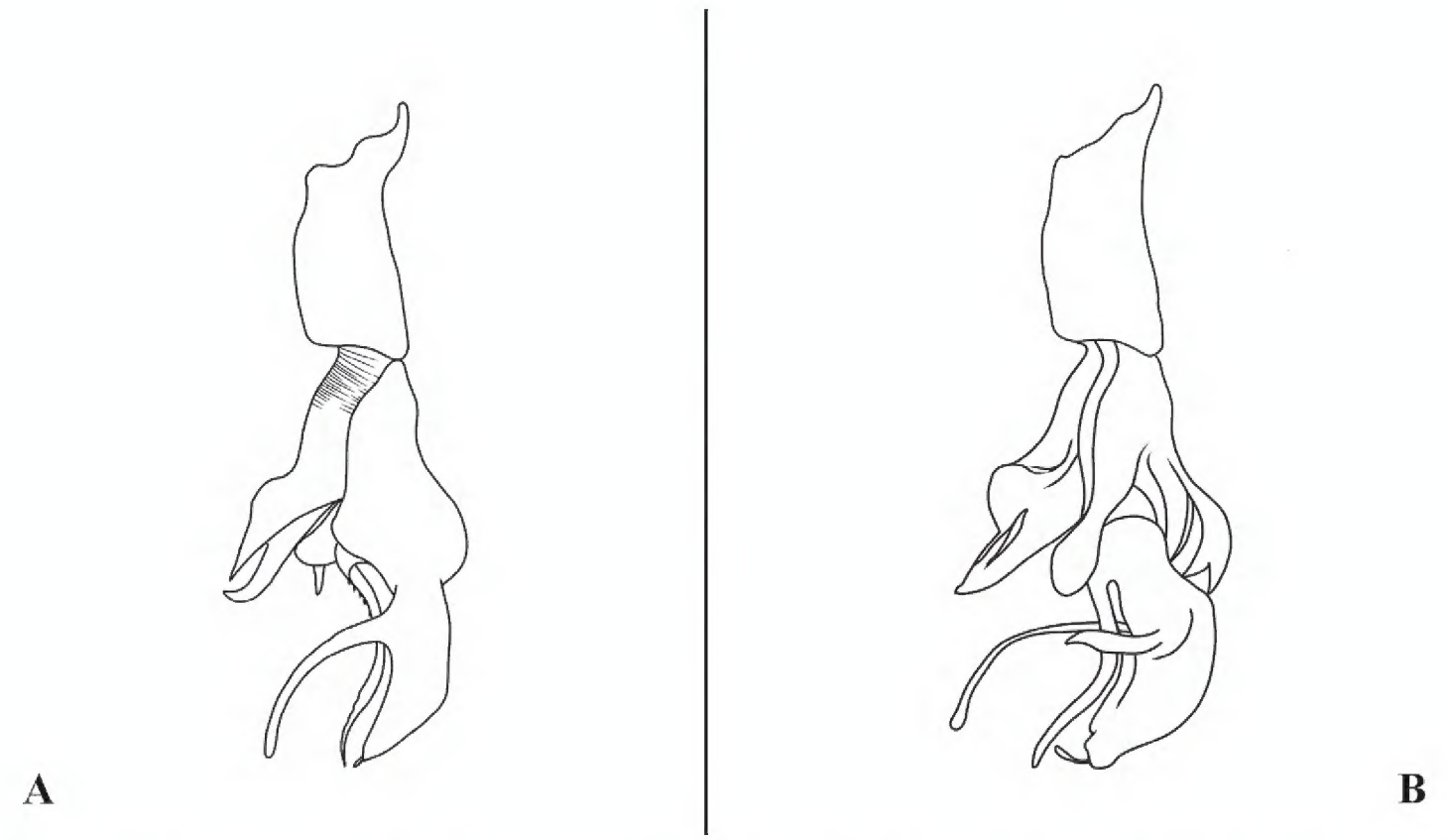

Figure 6. *Sarcophaga* (*Liosarcophaga*) *kanoi* Park, 1962; phallus, lateral view **A** adapted from Lehrer (2012) **B** adapted from Wei & Yang (2007, as *Pierretia autochthona*).

Sarcophaga (*Phallantha*) *sichotealini* (Rohdendorf, 1938)

Fig. 7

Phallantha sichotealini Rohdendorf, 1938: 102. Russia, Primorye, Sikhote-Alin State Reservation.

Pierretia daozhenensis Wei in Wei & Yang, 2005: 424. China, Guizhou, Daozhen, Dashahe. Syn. nov.

Material examined. 1♂, Russia, Primorye, SE Ussurijsk, 8.viii.1983, A. Ozerov leg. (NHMD). 1♂, China, Sichuan, Baoxing, 8.v.1981, unknown leg.; 1♂, China, Sichuan, Ya'an, 29.iv.2002, unknown leg. (SECA).

Remarks. The holotype of *P. daozhenensis* is deposited in CDCP and not currently available for loan and study. This nominal species was not included by Verves (2020), probably in an oversight. Wei (2005) described the vesica as flower-like, the cerci as having pointed apices and being slightly bent in lateral view, and the juxtal

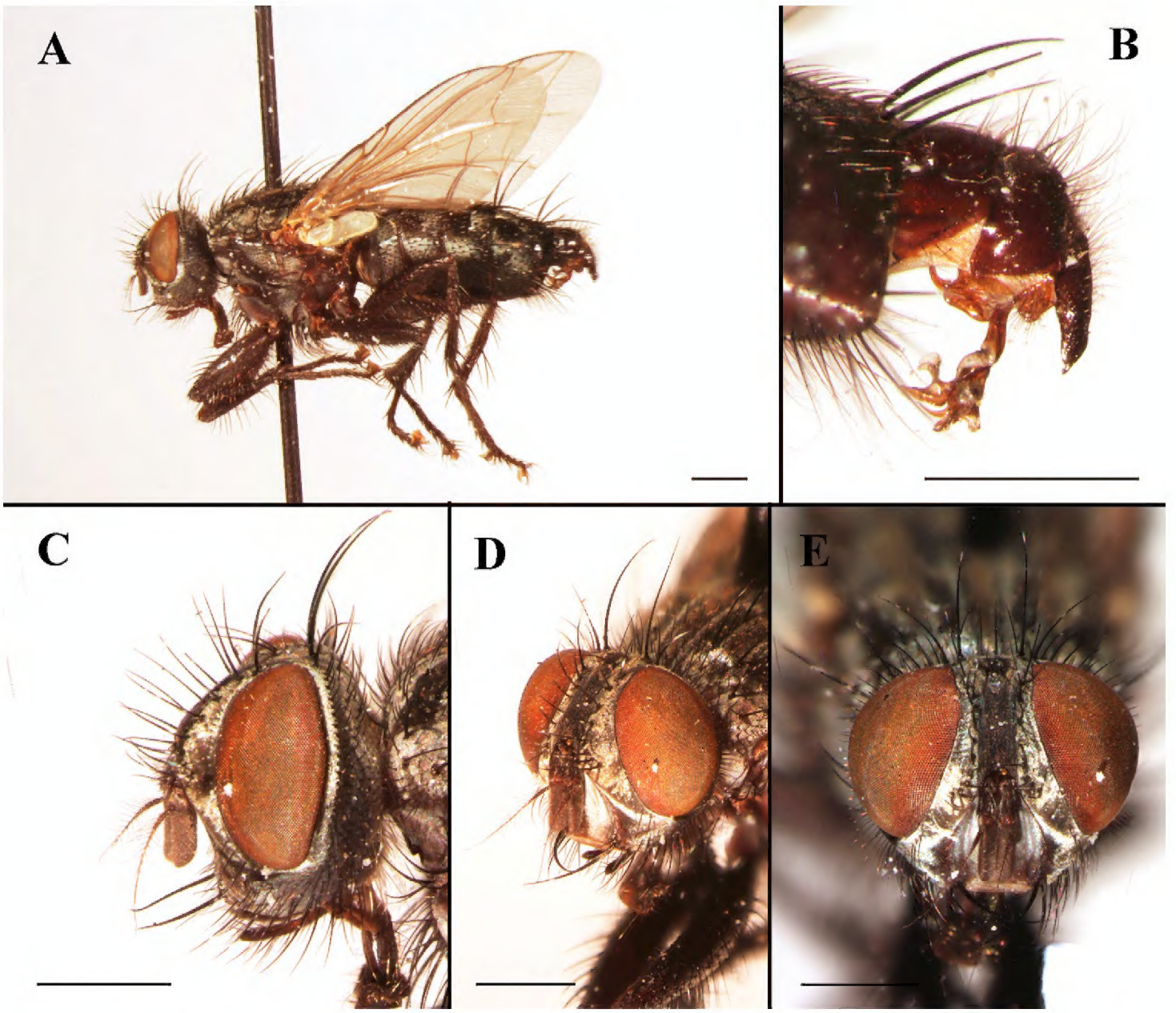

Figure 7. *Sarcophaga* (*Phallantha*) *sichotealini* (Rohdendorf, 1938); male (China, Sichuan; in SECA) **A** habitus, lateral view **B** terminalia, lateral view **C** head, lateral view **D** head, anterolateral view **E** head, anterior view. Scale bars: 1 mm.

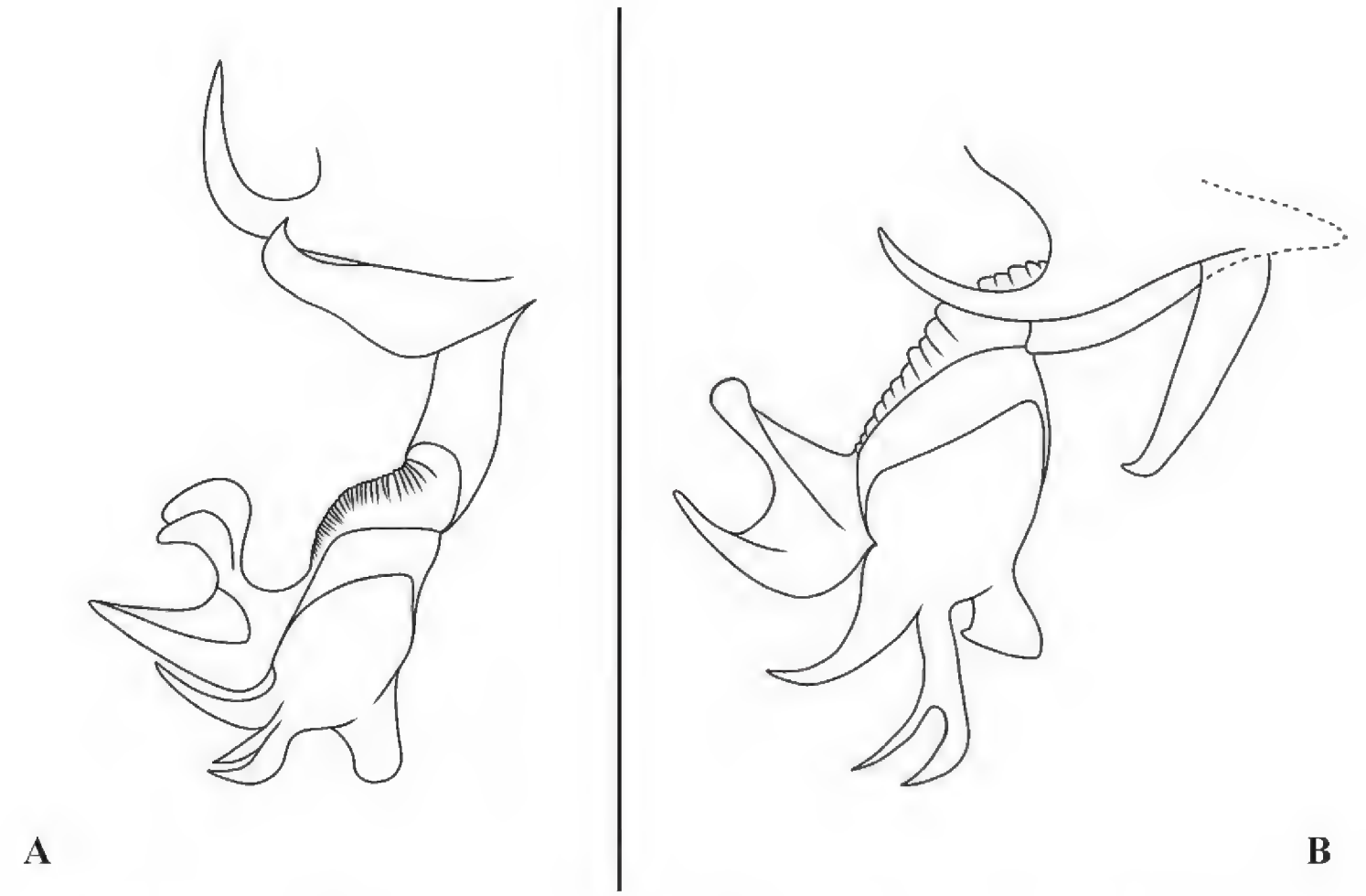

Figure 8. *Sarcophaga* (*Phallantha*) *sichotealini* Rohdendorf, 1938; phallus, lateral view **A** illustrated from figure 7B **B** adapted from Wei and Yang (2005, as *Pierretia daozhenensis*).

extension as well developed, flexed at its base and bent forward apically (Fig. 4). All of these features are consistent with *S. sichotealini*, and we consider the illustrations of the phallus provided by Xue and Chao (1998: 677, fig. 1332 m), and Wei and Yang (2005: fig. 3) to be a fully acceptable match (Fig. 8). We notice that Wei and Yang (2005) mentioned that *P. daozhenensis* was assigned to *Pierretia* using the key by Xue and Chao (1998), but the species was not assigned to any of the subgenera applied by Xue and Chao (1998), which includes *Phallantha.* Wei and Yang (2005) made no discussion about the subgeneric affiliation of *P. daozhenensis*, and there is no comparison with *P. sichotealini* in spite of the significant similarities with the illustration provided by Xue and Chao (1998). Vesica and harpes are of the same overall configuration, and as these are composed of flattened, partly membranous structures, even small changes in orientation may result in considerable changes in outline. The juxta has a very characteristic shape, with an almost exact match. *Sarcophaga* (*P.*) *sichotealini* is distributed in China (Guizhou, Hunan, Sichuan, Yunnan), the Russian Far East, South Korea, and temperate Japan (Pape 1996; Xue and Chao 1998; Verves 2020).

Subgenus *Pterosarcophaga* Ye, 1981

Pterosarcophaga Ye, 1981: 229. Type species: *Pterosarcophaga emeishanensis* Ye & Ni, 1981, by original designation.

Pterosacophaga: Ye 1981: 230. Incorrect original spelling of *Pterosarcophaga*, by First Reviser action of Ye (1982: 21).

Magnicauda Wei, 2005: 405. Type species: *Magnicauda linjiangensis* Wei, 2005, by original designation. Syn. nov.

Maginicauda: Wei 2005: 409. Incorrect original spelling of *Magnicauda*, by First Reviser action in the present paper.

Remarks. Monotypic subgenera in *Sarcophaga* (*sensu lato*) are often erected for lack of evidence as to their phylogenetic relationships, and as such they convey little if any information. We prefer a classification based on similarities rather than on differences, and as Wei (2005) considered *Magnicauda* to be closely related to *Pterosarcophaga* due to the male cerci of the type species of both subgenera being expanded, wing-like, in lateral view, we are here treating the two nominal subgenera as synonyms.

Ye in Ye and Ni (1981) provided two different spellings: "*Pterosarcophaga*" (pp. 229, 232, 233) and "*Pterosacophaga*" (p. 230). By using only the spelling "*Pterosarcophaga*", Ye (1982: 21) acted as First Reviser according to Article 24.2.4 of the Code.

Wei (2005) provided two different spellings: "*Magnicauda*" (pp. 404–406, 408) and "*Maginicauda*" (p. 409). Since then, the only mention of this genus-group name we have found is that of Verves (2020: 48); however, as only the spelling "*Maginicauda*" was used, the criteria of Article 24.2.3 for a First Reviser action were not fulfilled. Wei (2005) did not provide an explicit etymology, but the description of a remarkably broad male cercus is here taken to indicate that "*Magnicauda*" was the intended spelling. This is supported by the repeated use of this spelling, whereas the spelling "*Maginicauda*" was used only once. We herewith select "*Magnicauda*" to be the correct original spelling, by First Reviser action.

Sarcophaga (*Pterosarcophaga*) *linjiangensis* (Wei, 2005)

Fig. 9

Magnicauda linjiangensis Wei, 2005: 405. China, Guizhou, Xishui, Linjiang National Nature Reserve.

linjianensis: Wei 2005: 408, incorrect original spelling of *linjiangensis* Wei, 2005, by First Reviser action in the present paper.

Material examined. None.

Remarks. This species can be distinguished from other species of *Sarcophaga* by the flag-like pregonite. Wei (2005) provided two different spellings: "*linjiangensis*" (pp. 404–406, 409) and "*linjianensis*" (p. 408). Since then, the only mention of the species we have found is that of Verves (2020: 48); however, as only the spelling "*linjiangensis*" was used, the criteria for a First Reviser action were not fulfilled (see Art. 24.2.3 of the Code). As the species was evidently named after its type locality, we herewith select "*linjiangensis*" as the correct original spelling by First Reviser action.

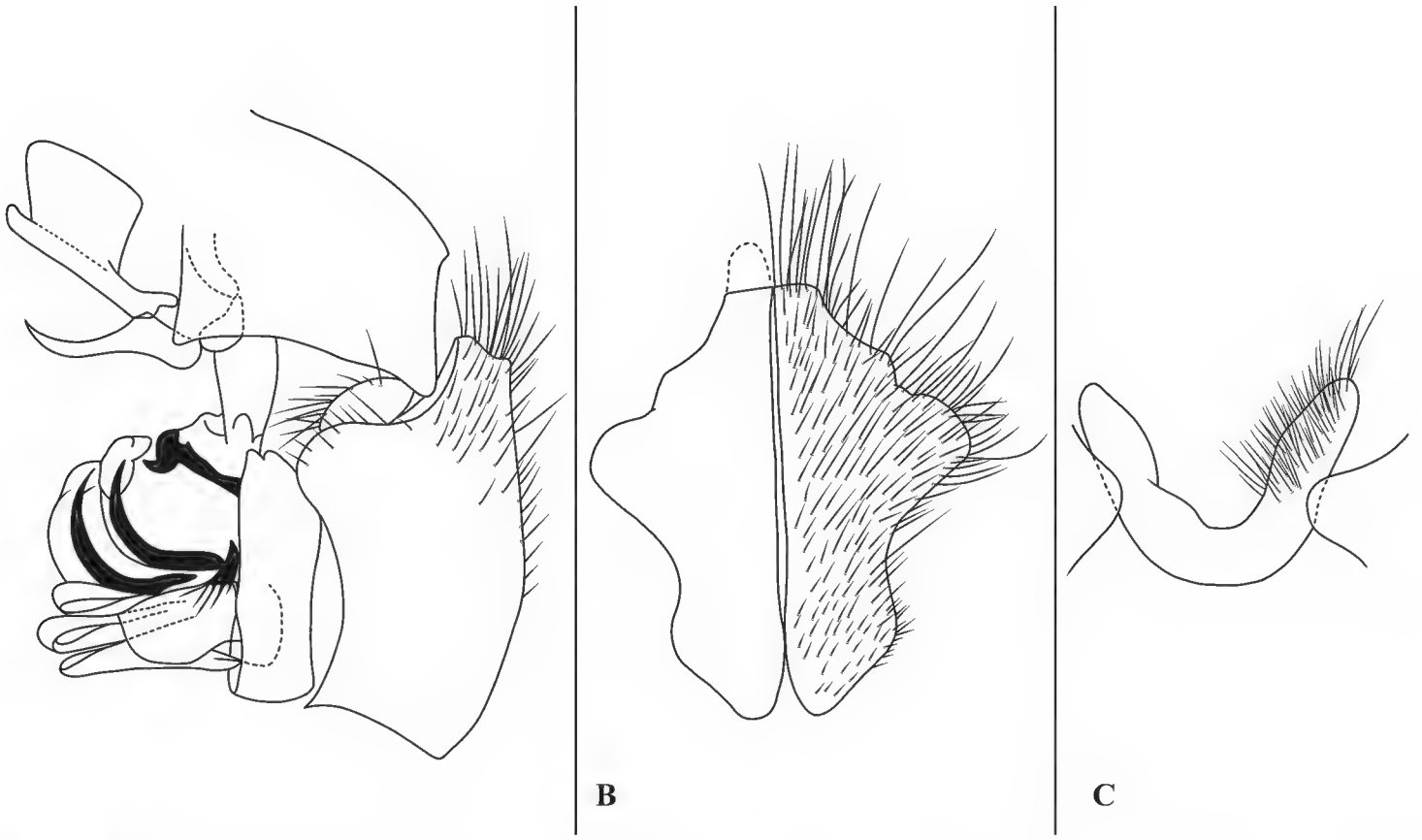

Figure 9. *Sarcophaga* (*Pterosarcophaga*) *linjiangensis* (Wei, 2005); male terminalia **A** terminalia, lateral view **B** cerci, dorsal view **C** sternite 5, ventral view. (Adapted from Wei 2005).

Subgenus *Robineauella* Enderlein, 1928

Robineauella Enderlein, 1928: 23 (as subgenus of *Parasarcophaga* Johnston & Tiegs, 1921). Type species: *Sarcophaga scoparia* Pandellé, 1896 [= *Sarcophaga caerulescens* Zetterstedt, 1838], by original designation.

***Sarcophaga* (*Robineauella*) *huangshanensis* (Fan, 1964)**
Figs 10–12

Parasarcophaga (*Robineauella*) *huangshanensis* Fan, 1964: 312. China, Anhui, Huang-Shan.
Parasarcophaga simultaneousa Wei & Yang, 2007: 528. China, Guizhou, Leigongshan. Syn. nov.

Material examined. ***Holotype*** of *Parasarcophaga* (*Robineauella*) *huangshanensis* Fan, 1964: ♂, China, Anhui, Huangshan, 19.vi.1936, [unknown collector] [terminalia not recovered]. ***Paratypes*:** 2♂♂, China, Zhejiang, Tianmu mountain, 1100 m, 5.vii.1962, Zhizi Chen leg. (SECA).

Remarks. We examined the type series of *S.* (*R.*) *huangshanensis* and found that the male terminalia are a close match with the description and illustrations provided for *P. simultaneousa* (Figs 11, 12). The most important difference would be

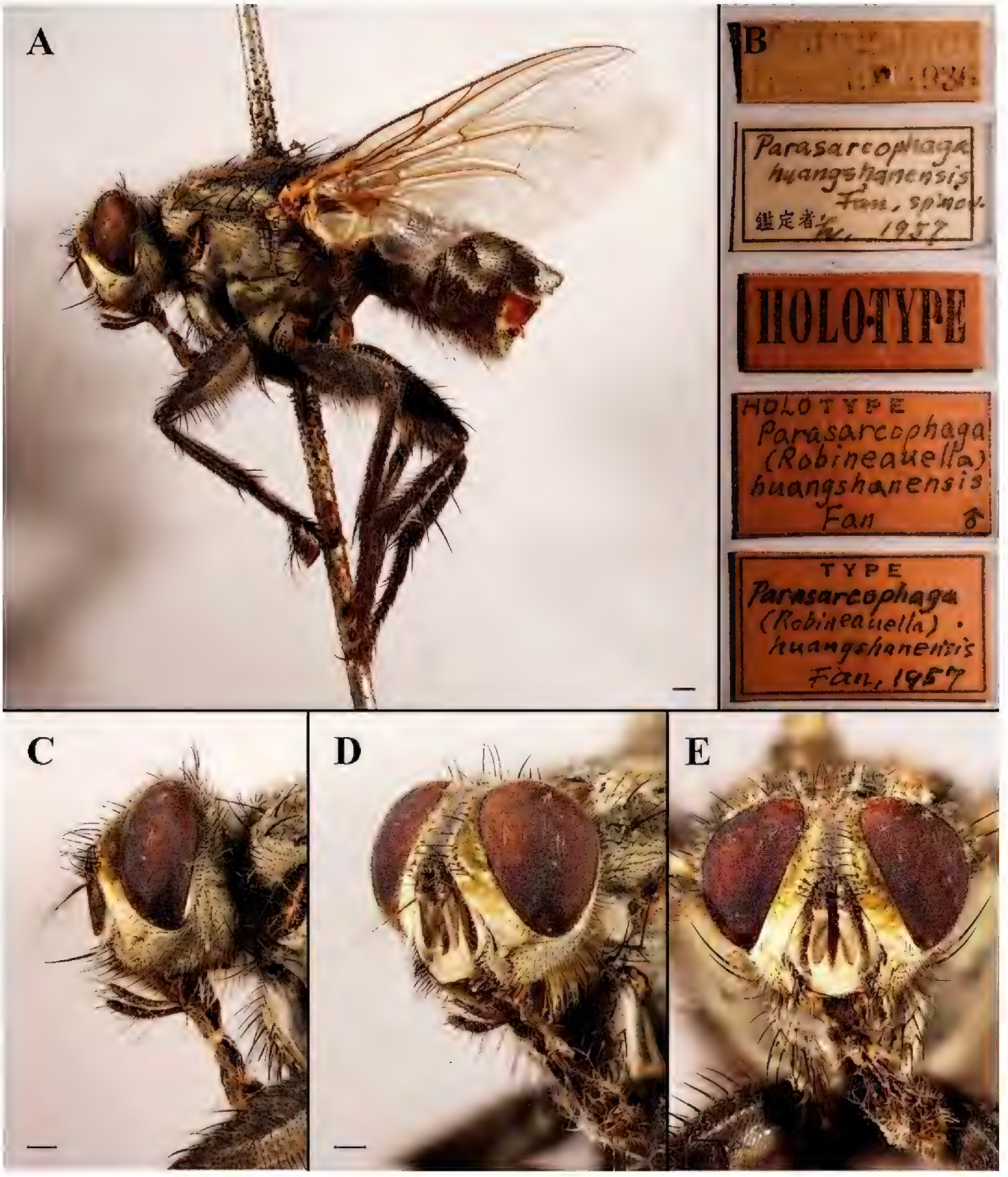

Figure 10. *Sarcophaga* (*Robineauella*) *huangshanensis* (Fan, 1964); holotype (China, Anhui; in SECA) **A** habitus, lateral view **B** labels **C** head, lateral view **D** head, anterolateral view **E** head, anterior view. Scale bars: 1 mm.

the difference in thickness of the proximal part of the juxtal processes, but this is here considered as infraspecific variation. Wei and Yang (2007) noted that this species could be confused with *S.* (*Liosarcophaga*) *kitaharai* Miyazaki, 1958; however, the latter, as a member of *Liosarcophaga* Rohdendorf, 1937, has a distiphallus with a better-developed dorso-median juxtal extension and an almost right-angled apico-dorsal part of juxta (Figs 11b, 12b, c). Lehrer (2012) examined the holotype

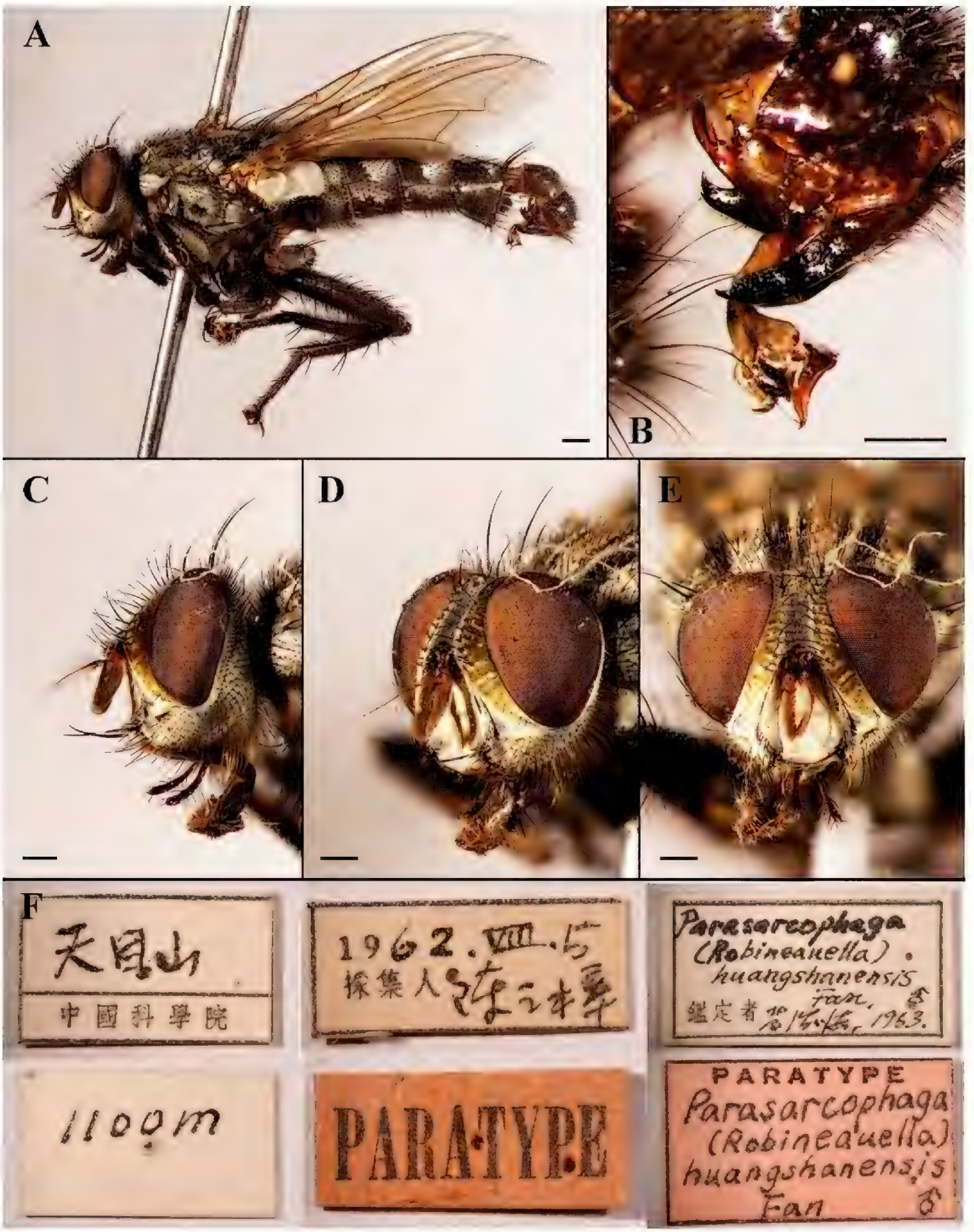

Figure 11. *Sarcophaga* (*Robineauella*) *huangshanensis* (Fan, 1964); paratype (China, Anhui; in SECA) **A** habitus, lateral view **B** terminalia, lateral view **C** head, lateral view **D** head, anterolateral view **E** head, anterior view **F** labels. Scale bars: 1 mm.

of *S. simultaneousa* and mentioned a similarity to *R. daurica* Grunin, 1964 and *R. mendeliana* Lehrer, 2008 (as "*mendelliana*"); however, he did not mention *S.* (*R.*) *huangshanensis*, maybe by an oversight.

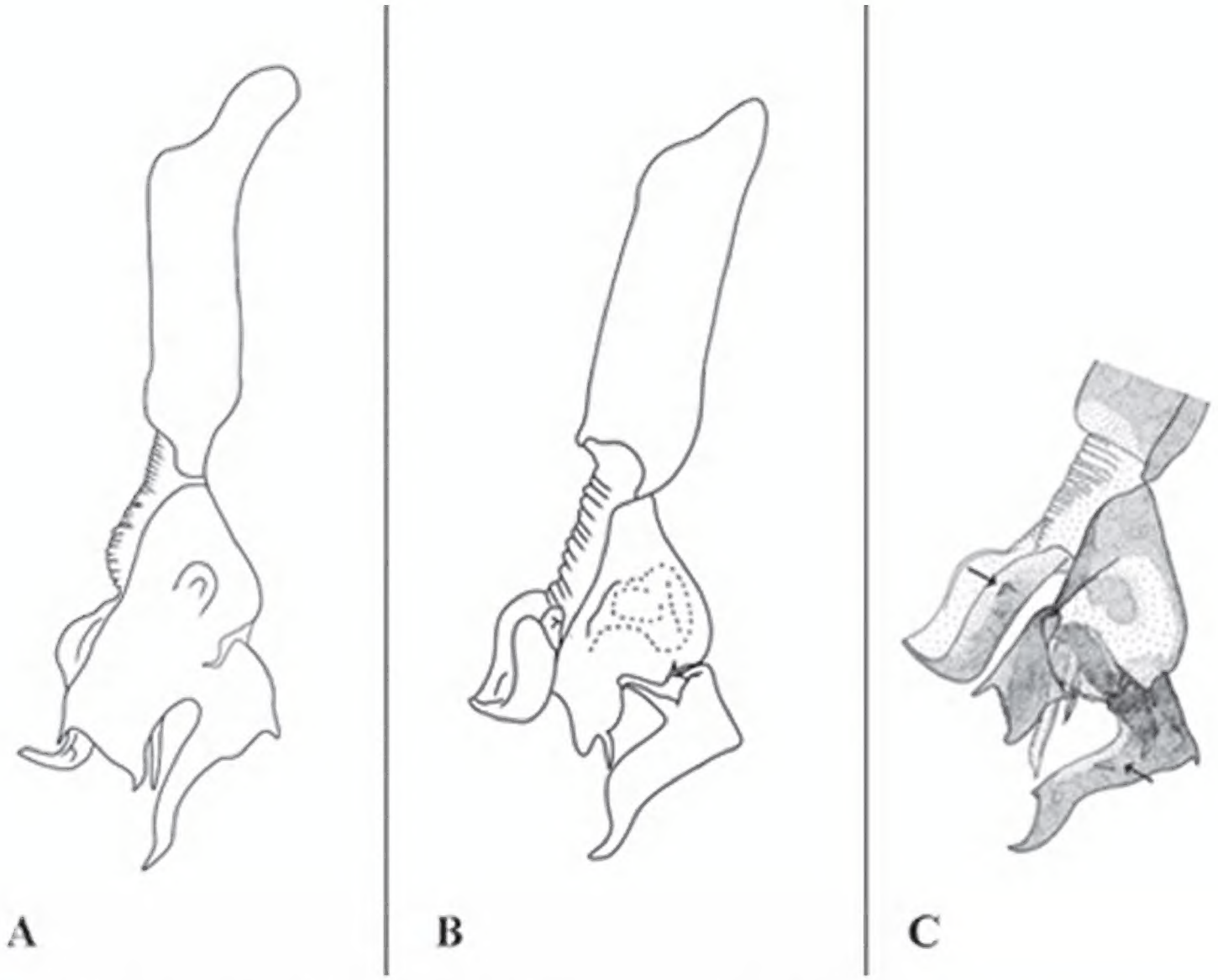

Figure 12. *Sarcophaga* (*Robineauella*) *huangshanensis* (Fan, 1964); phallus, lateral view **A** adapted from Fan (1964) **B** adapted from Wei and Yang (2007, as *Parasarcophaga simultaneousa*) **C** adapted from Lehrer (2012, as *Robineauella simultaneousa*).

Acknowledgements

We sincerely thank Prof. Zongmao Ye of the Institute of Microbiology and Epidemiology, Academy of Military Medical Sciences, Beijing, China, for help with checking of specimens and for advice. This study was supported by the National Key Research and Development Program of China (no. 2020YFC1200101), National Science Foundation of China (no. 31872964, 31572305), and the Beijing Forestry University Outstanding Young Talent Cultivation Project (no. 2019JQ03018).

References

Böttcher GH (1912) Sauters Formosa-Ausbeute. Genus *Sarcophaga*. Entomologische Mitteilungen 1: 163–170. https://doi.org/10.5962/bhl.part.25902

Buenaventura E, Pape T (2018) Phylogeny, evolution and male terminalia functionality of Sarcophaginae (Diptera: Sarcophagidae). Zoological Journal of the Linnean Society 183(4): 808–906. https://doi.org/10.1093/zoolinnean/zlx070

Buenaventura E, Whitmore D, Pape T (2017) Molecular phylogeny of the hyperdiverse genus *Sarcophaga* (Diptera: Sarcophagidae), and comparison between algorithms for identification of rogue taxa. Cladistics 32(2): 109–133. https://doi.org/10.1111/cla.12161

Downes WLJ (1965) Family Sarcophagidae. In: Stone A, Sabrosky CW, Wirth WW, Foote RH, Coulson JR (Eds) A catalog of the Diptera of America north of Mexico. United States Department of Agriculture, Washington, DC, 1965, 933–961. https://handle.nal.usda.gov/10113/CAT87208336

El-Ahmady A, Taha M, Soliman AM, El-Hawagry M (2018) A new species and new records of the genus *Sarcophaga* from Egypt, with a key to the known Egyptian species (Diptera: Sarcophagidae). African Entomology 26(2): 507–521. https://doi.org/10.4001/003.026.0507

Enderlein G (1928) Klassifikation der Sarcophagiden. Sarcophagiden-Studien I. Archiv für klassifikatorische und phylogenetische Entomologie 1: 1–56.

Evenhuis NL, Pape T [Eds] (2021) Systema Dipterorum, Version 3.1. http://diptera.org/ [accessed on 30 July 2021]

Fan ZD (1964) Descriptions of some new Sarcophagini from China (Diptera: Sarcophagidae). Dong Wu Fen Lei Xue Bao 1(2): 305–319.

Fan ZD (1992) Key to the common flies of China. Second edition. Shanghai Institute of Entomology, Academia Sinica, [xlviii+]992 pp.[, 40 pls] [in Chinese with English subtitle and preface. English descriptions of all new taxa pp. 912–927]

Fan ZD, Kano R (2000) New genus and new species of the tribe Sarcophagini from Yunnan, China (Diptera: Sarcophagidae). In: Aoki JI, Yin WY, Imadaté G (Eds) Taxonomical Studies on the Soil Fauna of Yunnan Province in Southwest China. Tokai University Press, Tokyo, 251–255.

Giroux M, Pape T, Wheeler TA (2010) Towards a phylogeny of the flesh flies (Diptera: Sarcophagidae): morphology and phylogenetic implications of the acrophallus in the subfamily Sarcophaginae. Zoological Journal of the Linnean Society 158(4): 740–778. https://doi.org/10.1111/j.1096-3642.2009.00561.x

Gregor F, Povolný D (1960) Beitrag zur Kenntnis der synanthroper Fliegen Ungarns. Acta Societatis Entomologicae Čechoslovenicae 57(2): 158–177.

ICZN [International Commission on Zoological Nomenclature] (1999) International Code of Zoological Nomenclature. 4th Edn. International Trust for Zoological Nomenclature, London, [xxix +] 306 pp. https://code.iczn.org

Lehrer AZ (1995) Distinction taxonomique entre les espèces paléarctiques *Liosarcophaga aegyptica* (Salem) et *Liosarcophaga parkeri* (Rohdendorf) et description de deux espèces nouvelles afrotropicales (Diptera, Sarcophagidae). Revue Roumaine de Biologie. Série de Biologie Animale 40(1): 11–17.

Lehrer AZ (2010) Le genre *Pachystyleta* Fan et Chen de la faune de Chine et sa composition spécifique (Diptera, Sarcophagidae). Fragmenta Dipterologica 26: 14–18.

Lehrer AZ (2012) Taxonomic Atlas of the postabdominal structures Sarcophagidae (Insecta, Diptera) Vol. II. Entomologica, Bari 44: 3–158.

Linnaeus C (1758) Systema naturae per regna tria naturae, secundum classes, ordines, genera, species, cum characteribus, differentiis, synonymis, locis, Tomus I. Editio decima, reformata. Laurentii Salvii, Stockholm, [4 +] 823 [+ 1] pp. https://doi.org/10.5962/bhl.title.542

Meigen JW (1824) Systematische Beschreibung der bekannten europäischen zweiflügeligen Insekten. Vierter Theil. Schulz-Wundermann, Hamm. [xii +] 428 pp.[, pls 33–41]

Miyazaki T (1958) Notes on the flies of medical importance in Kyushu, Japan. I. Descriptions of one new species and one newly found species of *Sarcophaga* from Japan. Acta medica Universitatis Kagoshima 1: 143–147.

Nandi BC (2002) Diptera Sarcophagidae. Zoological Survey of India 10: [i–xxiv,] 1–608.

Pandellé L (1896) Études sur les muscides de France. II[e] partie (suite). Revue Entomologique 15: 1–230.

Pape T (1996) Catalogue of the Sarcophagidae of the world (Insecta: Diptera). Memoirs on Entomology. International 8: 1–558.

Pape T, Bänziger H (2003) Three new species of *Sarcophaga* Meigen found during ecological studies on flesh flies (Diptera: Sarcophagidae) in Thailand. Entomological Science 6(1): 49–56. https://doi.org/10.1046/j.1343-8786.2003.00004.x

Pape T, Dahlem GA (2010) Sarcophagidae. In: Brown BV, Borkent A, Cumming JM, Wood DM, Woodley NE, Zumbado M (Eds) Manual of Central American Diptera. Vol. 2. NRC Research Press, Ottawa,1313–1335. https://doi.org/10.1590/S0085-56262011005000051

Park SH (1962) Descriptions of two new species of sarcophagid flies (Diptera: Sarcophagidae) from Korea. Japanese Journal of Sanitary Zoology 13(1): 6–10. https://doi.org/10.7601/mez.13.6

Partington CF (1837) The British Cyclopædia of Natural History: Combining a Scientific Classification of Animals, Plants, and Minerals: with a Popular View of their Habits. Economy, and Structure 3(Part 37): 577–640.

Povolný D, Hula V (2004) On an invasion of the flesh-fly *Liosarcophaga aegyptica* (Salem, 1935) into Central Europe with the discovery of *Helicophagella verstraeteni* (Lehrer, 1975) in East Slovakia (Diptera, Sarcophagidae). Acta Universitatis Agriculturae et Silviculturae Mendelianae Brunensis 52(4): 91–101. https://doi.org/10.11118/actaun200452040091

Richet R, Blackith RM, Pape T (2011) Sarcophaga of France (Diptera: Sarcophagidae). Pensoft Publishers, Sofia, 327 pp.

Roback SS (1954) The evolution and taxonomy of the Sarcophaginae. Illinois Biological Monographs 23: 1–181.

Rohdendorf BB (1937) Fam. Sarcophagidae (part 1), Fauna SSSR, New Series, No. 12. Izdatelstvo Akademii Nauk SSSR, Moskva–Leningrad, 500 pp.

Rohdendorf BB (1938) Transactions Sikhote-Alin State Reserve 1938(2): 101–110. [New species of Sarcophaginae from the Sichote-Alin State Reserve Territory.] [in Russian]

Rohdendorf BB (1970) [Fam. Sarcophagidae – sarcophagids.] In: Bei-Bienko GYa (Ed.) Keys to the Insects of the European Part of the USSR 5(2): 624–670. [in Russian]

Salem HH (1935) The Egyptian species of the genus *Sarcophaga*. Publications of the Egypt University. Faculty of Medicine 5: 1–61.

Schiner IR (1868) Diptera. In: Reise der österreichischen Fregatte Novara um die Erde in den Jahren 1857, 1858, 1859 unter den Befehlen des Commodore B. von Wüllerstorf-Urbair. Zoologischer Theil. Zweiter Band. 1. Abtheilung. Wien, [vi +] 388 pp. [+ 4 pls]

Thomas HT (1949) New species of Oriental *Sarcophaga* Meigen (Diptera: Calliphoridae) with a note on the systematic importance of the postsutural dorsocentral bristles in that genus. Proceedings of the Royal Entomological Society of London 18: 163–174. https://doi.org/10.1111/j.1365-3113.1949.tb01441.x

Verves YuG (2020) An annotated list of Chinese Sarcophagidae (Diptera). Suplementos del Boletín de la Asociación Española de Entomología 1: 1–68.

Verves YuG, Khrokalo LA (2020) Review of the taxa of Calliphoridae and Sarcophagidae (Diptera) studied by the late Prof. Andy Z. Lehrer. Priamus 44: 1–282.

Wang C, Gao YY, Pape T, Zhang D (2019) Redefinition of *Cornexcisia* Fan and Kano, 2000 (Diptera: Sarcophagidae), with the first description of the female of *Sarcophaga kurahashii* (Shinonaga and Tumrasvin, 1979). Zootaxa 4668(3): 410–420. https://doi.org/10.11646/zootaxa.4668.3.6

Wang C, Xue WQ, Zhang D, Pape T (2020) A new species of *Sarcophaga* Meigen subgenus *Hoa* Rohdendorf (Diptera: Sarcophagidae). Zootaxa 4821(3): 585–593. https://doi.org/10.11646/zootaxa.4821.3.9

Wei LM (2005) Sarcophagidae. In: Jin DC, Li ZZ (Eds) Insects from Xishui Landscape. Guizhou Science and Technology Publishing House, Guiyang, 404–409. [in Chinese with English summary]

Wei LM, Yang ZH (2005) Diptera: Anthomyiidae, Fanniidae, Muscidae, Calliphoridae and Sarcophagidae. In: Yang MF, Jin DC (Eds) Insects from Dashahe Nature Reserve of Guizhou. Guizhou Peoples Publishing House, Guiyang, 422–427. [in Chinese with English summary]

Wei LM, Yang ZH (2007) Sarcophagidae. In: Li ZZ, Yang MF, Jin DC (Eds) Insects from Leigongshan Landscape. Guizhou Science and Technology Publishing House, Guiyang, 526–539. [in Chinese with English summary]

Whitmore D, Pape T, Cerretti P (2013) Phylogeny of *Heteronychia*: the largest lineage of *Sarcophaga* (Diptera: Sarcophagidae). Zoological Journal of the Linnean Society 169(3): 604–639. https://doi.org/10.1111/zoj.12070

Xue Wq, Chao Cm (1998) Flies of China. Liaoning Science and Technology Press, Shenyang, 2425 pp.[, 32 pls]

Xue Wq, Verves YuG (2009) *Perisimyia perisi*, a new genus and species from South China (Diptera: Sarcophagidae). Boletin de la Asociacion Espanola de Entomologia 33(1–2): 43–58.

Xue W, Verves YG, Du J (2011) A review of subtribe Boettcheriscina Verves 1990 (Diptera: Sarcophagidae), with descriptions of a new species and genus from China. Annales de la Société Entomologique de France 47(3–4): 303–329. https://doi.org/10.1080/00379271.2011.10697723

Ye ZM (1981) [Description of *Pterosarcophaga*.] In: Ye ZM, Ni T, Liu ZJ (Eds) Descriptions of a new genus and two new species of the tribe Sarcophagini (Diptera: Sarcophagidae). Zoological Research 2: 229.

Ye ZM (1982) The checklist of Chinese Sarcophaginae. China Academic Journal Electronic Publishing House 11–23.

Ye ZM, Ni T (1981) [Description of *Pterosarcophaga emeishanensis*.] In: Ye ZM, Ni T, Liu ZJ (Eds) Descriptions of a new genus and two new species of the tribe Sarcophagini (Diptera: Sarcophagidae). Zoological Research 2: 229.

Zetterstedt JW (1838) tertia. Diptera. Dipterologis Scandinaviae amicis et popularibus carissimus. In: Zetterstedt JW (Ed.) Insecta Lapponica (1838–1840). L. Voss, Leipzig, [477]–868. https://doi.org/10.5962/bhl.title.8242